GE Power Management

Digital Breaker Failure Protection

DBF

Instructions

GEK 106168E

Anything you can't find?

Anything not clear enough?

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TABLE OF CONTENTS

LIST OF FIGURES

1. GENERAL DESCRIPTION AND APPLICATION

1.1. GENERAL DESCRIPTION

The DBF system is a microprocessor based breaker failure protection, control and measurement unit that has different algorithms to allow its use on a wide range of applications in power systems.

The functions and information management of the unit can be performed remotely (computer connected to the serial port RS232, fiber-optic or modem) or locally using the man-machine interface (HMI), which includes a 20 keys keypad, and a two line liquid crystal display (LCD) on the front of the relay.

The system provides the following functions:

a) Protection

- **Low current level** breaker failure protection, following a single or three phases initiation, with up to two time delayed steps.
- **High current level** breaker failure protection, following a two/three (selectable by setting) phases initiation.
- **No current** breaker failure protection, following a two/three (selectable by setting) phases initiation.
- Breaker **internal arc detection**.

b) Monitoring

- Current measurements for each phase and ground.
- Breaker status
- 16 fully configurable LED indicators
- One fixed relay status LED
- Breaker health monitoring ($\Sigma I^2 t$).
- Built-in self-check functions.

c) Analysis:

- Event recorder
- Oscillography

d) Control:

- 3 settings' tables
- Time synchronization using the communications program, the IRIG-B input or the HMI (keypad and display).
- Configurable inputs and outputs.
- User can build logic schemes using AND, OR and NOT gates and the internal digital signals of the relay.

e) Communication Interfaces

- Remote communications through three communication ports, one on the front of the relay and two located on the rear.
- Human machine interface (HMI) consisting of 20 keys keypad and alphanumerical LCD (16 characters x 2 lines).
- Windows™ based GE-INTRO configuration software (for inputs, outputs, LEDs configuration) and GE-LOCAL communications software (for relay monitoring, settings change, stored data retrieve, etc). Both are part of the GE-NESIS software package (General Electric Network Substation Integrated System).

2. OPERATION LOGIC

(See figure 1 at the end of the Instruction Manual)

2.1. PROTECTION FUNCTIONS

2.1.1. OVERCURRENT UNITS

The DBF system incorporates the following overcurrent detectors:

- Three Single Phase Low-Level Overcurrent Detectors
  (Used by the **50BF 1P** function.)
- Three Single Phase High-Level Overcurrent Detectors.
  (Used by the **50BF 3P** function.)
- One Ground Overcurrent Detector.
  (Used by the **3P No I** function.)
- Three Single-Phase current detectors for the internal arc function.

Low-Level Overcurrent Breaker Failure Unit – 50BF 1P

The breaker failure operation is started by detecting any single phase above a setpoint threshold (**PH Lo-Set Pickup** setting), ANDed with a tripping signal (breaker failure initiate signal) issued by the main feeder protection. These breaker failure initiation signals can be single-phase or three-phase type at **OR1**, **OR2** and **OR3.** There are four digital signals available (**50BF Initiate A, 50BF Initiate B, 50BF Initiate C** and **3P BF Initiate**) assignable to any digital input (contact converter). The factory digital input configuration is the following (as shown in figure 1):

Digital Signal	Input #	Terminals
50BF Initiate A	Input #1	C9 – D10
50BF Initiate B	Input #2	D9 – D10
50BF Initiate C	Input #3	C10 – D10
3P BF Initiate	Input #7	E7 – E8

The **AND1**, **AND2** and **AND3** gates thus fully armed may perform (depending on settings) one or two time delayed tripping steps. Use **50BF 1P** setting (permitted/Not permitted) and number of output stages (**N. of Output Stages**) setting to enable this function and to set the number of steps. Timers T1 and T2nd control the timing of the first and second step respectively (**1 Phase Timer T1** and **2nd Stage Timer** settings).

If the tripping signal is three-pole type (digital input E7-E8 for the default factory configuration), the signal will be placed at the same time in **OR1**, **OR2** and **OR3** and then to **AND1**, **AND2** and **AND3**.

High-Level Overcurrent Breaker Failure Unit – 50BF 3P

This function operates if high-Level overcurrent is detected on 2 phases (or 3 phases if setting **BF Logic (3P/2P)** is set to 3P) and if 2 breaker failure initiation inputs are energized (or just the **3P BF Initiate** input, if **Severe Fault 3P** setting is set to permitted).

The starting of this function is similar to the **50BF 1P**, but in this case the current level setting range is higher (**PH Hi-Set Pickup** setting) and the output is controlled by the energization of two single pole initiation signals. This function can also operate energizing the **3P BF Initiate** signal, if **Severe Fault 3P** setting is set to 'permitted'.

Other difference with respect to the **50BF 1P** function, is that the current in all the three phases must exceed the setpoint, or at least one pair of phases. This is selected with **BF Logic (3P/2P)** setting. In the first case (**BF Logic (3P/2P)** set to 3P) the signal should progress through **AND11** and **AND12.** If **BF Logic (3P/2P)** is set to 2P, then the signal will go through **AND8**, **AND9** or **AND10** and then **AND13.** The outputs of **AND12** or **AND13** are sent via

OR5 to the bottom input of **AND4**. Any pair of single BF initiation signals placed at **AND5**, **AND6**, or **AND7** will activate the top input of **AND4**. This input to **AND4** can also be ON if there is a 3P BF Initiation and **Severe Fault 3P** setting is set to 'permitted'.

Ground Overcurrent Breaker Failure Unit.

The breaker failure action based in this ground overcurrent function basically performs an additional breaker failure function through **AND19**, when the **3P BF Initiate** (or 2 Single Pole BF Initiate, if **Low Load 2P** setting is set to 'permitted') is present at **OR10** and a ground current higher than **Neutral Pickup** setting is detected.

Breaker Failure without current (or very low current).

DBF includes internal logic to cover also no-current, or very low fault current BF applications. This function will issue an output if the **3P BF Initiate** input is energized (or 2 Single Pole BF Initiate, if **Low Load 2P** setting is set to 'permitted'), and at least one pole of the circuit breaker is still closed.

Breaker Arc Detection Device.

This function may close one output of the relay when it detects that: the circuit breaker is open and some amount of current is present in any phase. There are two settings available for this function: '**Internal Arc Pickup**' to set the current threshold and '**Internal Arc Timer**' to coordinate the operation time of the unit with the time it takes for the breaker and auxiliary elements to open.

If the circuit breaker is open, then the 52/b contacts will energize the digital inputs corresponding to the circuit breaker status (terminals **C11-D12**, **D11-D12** and **C12-D12** for the factory default configuration), and then the upper input of **AND16**, **AND17** and **AND18.** The other input will be energized if the DBF detects a current higher than **Internal Arc Pickup** setting. The outputs of these AND gates are sent to **OR8** and then to timer **T4** (**Internal Arc Timer** setting) to complete the arc detection function, this will close the auxiliary relay **D2-C2** (according to the factory default output configuration).

Reset of Latching Relays

The DBF breaker failure protection may be ordered with an expansion board, which includes two latching relays that are operated in different ways depending on the number of steps selected (for additional reference see Figure 1), and will fix the tripping output once the breaker failure function has operated. A digital input through F11-F12 (factory default inputs configuration) (pulse signal, not sustained) resets these latching relays to its steady-state position.

2.2. MONITORING AND RECORDING FUNCTIONS

2.2.1 MEASUREMENT

The DBF system provides the continuous measurement of phase and ground current values.

These measurements can be accessed directly on the liquid crystal display (HMI) on the front of the relay, or via the **GE-LOCAL** communication software.

2.2.2 ASSOCIATED BREAKER STATUS

The DBF system monitors the associated breaker status through the digital inputs 52/b (or 52/a), and it is displayed on the local HMI or through the communications software.

2.2.3 TARGET LAMPS

The DBF incorporates 17 LED target lamps, one fixed LED (two colors) assigned to the system ready function, and 16 user configurable red LEDs. These configurable LEDs are arranged in two columns of 8 LEDs each. The configuration is done using the GE-INTRO software, and it consists on assigning an internal event (or an AND gate of internal events) to an LED. The LED can be configured to have memory (if Vdc is removed or the event causing the operation of the LED gets deactivated) or not and to blink or to be steady. The internal events must be previously defined using the internal signals of the relay. It is possible to use AND, OR and NOT logic gates to define these events. The available internal signals are listed in the following table.

The TARGET RESET button allows testing all target lamps if it is pushed for a short time (lighting up all of them), or resets the sealed-in targets if it remains pressed for three seconds or more.

Please refer to GE_INTRO (configuration software) Instruction book (GEK-105594) for further information.

INTERNAL PROTECTION STATUS SIGNALS

Group	Status	Comment
1.0	Program Initiate	Relay starts running (Vdc just applied).
1.1	Settings change	User changes any setting
1.2	Write Counters	User sets a value for any counter
1.3	Configuration Change	User changes relay configuration
1.4	External Trigger	Oscillography triggered by Dig. Input
1.5	Communications Trigger	Osc. triggered by HMI or GE_LOCAL
1.6	Reset Operation	Latched Relays Reset received
1.7		
1.8		
1.9		
1.10		
1.11		
1.12		
1.13		
1.14		
1.15		
2.0	Input Nº 1	Digital Input #1 Status
2.1	Input Nº 2	Digital Input #2 Status
2.2	Input Nº 3	Digital Input #3 Status
2.3	Input Nº 4	Digital Input #4 Status
2.4	Input Nº 5	Digital Input #5 Status
2.5	Input Nº 6	Digital Input #6 Status
2.6		

Group	Status	Comment
2.7		**Optional Exp. Board**
2.8	Input Nº 7	Digital Input #7 Status
2.9	Input Nº 8	Digital Input #8 Status
2.10	Input Nº 9	Digital Input #9 Status
2.11	Input Nº 10	Digital Input #10 Status
2.12	Input Nº 11	Digital Input #11 Status
2.13	Input Nº 12	Digital Input #12 Status
2.14	Input Nº 13	Digital Input #13 Status
2.15	Input Nº 14	Digital Input #14 Status
3.0	Breaker Failure Logic	BF Logic = 3P
3.1	Hi-Set A Pickup	Output of Hi-Set current detector ph A
3.2	Hi-Set B Pickup	Output of Hi-Set current detector ph B
3.3	Hi-Set C Pickup	Output of Hi-Set current detector ph C
3.4	50BF Pole A Initiate	CC1 Dig. Input ON (default configuration)
3.5	50BF Pole B Initiate	CC2 Dig. Input ON (default configuration)
3.6	50BF Pole C Initiate	CC3 Dig. Input ON (default configuration)
3.7	Lo-Set A Pickup	Output of Lo-Set current detector ph A
3.8	Lo-Set B Pickup	Output of Lo-Set current detector ph B
3-9	Lo-Set C Pickup	Output of Lo-Set current detector ph C
3.10	50BF 3 Phase Initiate	CC7 Dig. Input ON (default configuration)
3.11	50BF Neutral Initiate	Output of Neutral current detector
3.12	Internal Arc A Pickup	Output of AND 16 in figure 1
3.13	Internal Arc B Pickup	Output of AND 17 in figure 1
3.14	Internal Arc C Pickup	Output of AND 18 in figure 1
3.15		
4.0	Pickup	Any BF signal is activated. Output of OR 7 in figure 1
4.1	Trip 1	Any unit (except Internal Arc) has tripped. Output of OR 6 in figure 1
4.2	Trip 2	Same as Trip 1 when 1 step is selected. 2nd stage when 2 steps are selected. Output of AND 14 / 15 in figure 1
4.3	Internal Arc	Trip from Internal Arc unit. Output of Timer 4 in figure 1
4.4		
4.5		
4.6		
4.7		
4.8		
4.9		
4.10		
4.11		
4.12		
4.13		
4.14		
4.15		
5.0	Phase A Trip	Output of Timer 1 phase A in figure 1
5.1	Phase B Trip	Output of Timer 1 phase B in figure 1
5.2	Phase C Trip	Output of Timer 1 phase C in figure 1
5.3	Three-Pole Trip with Current	Output of Timer 2 in figure 1
5.4	Three-Pole Trip without Current	Output of Timer 3 in figure 1
5.5	Second Stage Trip	Output of AND 14 / 15 in figure 1
5.6		
5.7		
5.8		

Group	Status	Comment
5.9		
5.10		
5.11		
5.12		
5.13		
5.14		
5.15		
6.0		
6.1	Parallel EEPROM Alarm	Failure in parallel EEPROM
6.2	Serial EEPROM Alarm	Failure in serial EEPROM
6.3	Out-of-Service	Relay out of service
6.4	Default General Settings	Relay with factory default settings
6.5	Default Table 1 Settings	Table 1 with factory default settings
6.6	Default Table 2 Settings	Table 2 with factory default settings
6.7	Default Table 3 Settings	Table 3 with factory default settings
6.8		
6.9		
6.10		
6.11	52 A Maintenance Alarm	Accumulated I2t above limit for Phase A
6.12	52 B Maintenance Alarm	Accumulated I2t above limit for Phase B
6.13	52 C Maintenance Alarm	Accumulated I2t above limit for Phase C
6.14		
6.15		
7.0		
7.1	Active Table 1	Setting Table #1 is the active Table
7.2	Active Table 2	Setting Table #2 is the active Table
7.3	Active Table 3	Setting Table #3 is the active Table
7.4		
7.5		
7.6	New Events	There are new events stored in the DBF
7.7	Two Stages Set	BF Logic set to 2 timed stages
7.8	Breaker Pole A Status	CB Pole A Closed
7.9	Breaker Pole B Status	CB Pole B Closed
7.10	Breaker Pole C Status	CB Pole C Closed
7.11	Latching Relay 1 Status	**Optional Exp. Board: Latched#1 Closed**
7.12	Latching Relay 2 Status	**Optional Exp.Boar: Latched#2 Closed**
7.13		
7.14		
7.15		
8.0		
8.1		
8.2		
8.3		
8.4		
8.5		
8.6		
8.7		
8.8		

Group	Status	Comment
8.9		
8.10		
8.11		
8.12		
8.13		
8,14		
8.15		
9.0		
9.1		
9.2		
9.3		
9.4		
9.5		
9.6		
9.7		
9.8		
9.9		
9.10		
9.11		
9.12		
9.13		
9.14		
9.15		
10.0	AND1	Output of internal AND gate #1
10.1	AND2	Output of internal AND gate #2
10.2	AND3	Output of internal AND gate #3
10.3	AND4	Output of internal AND gate #4
10.4	AND5	Output of internal AND gate #5
10.5	AND6	Output of internal AND gate #6
10.6	AND7	Output of internal AND gate #7
10.7	AND8	Output of internal AND gate #8
10.8	AND9	Output of internal AND gate #9
10.9	AND10	Output of internal AND gate #10
10.10	AND11	Output of internal AND gate #11
10.11	AND12	Output of internal AND gate #12
10.12	AND13	Output of internal AND gate #13
10.13	AND14	Output of internal AND gate #14
10.14	AND15	Output of internal AND gate #15
10.15	AND16	Output of internal AND gate #16

INTERNAL COMMUNICATION STATUS SIGNALS

Group	Status	Comment
1.0	Remote/Local Mode	Relay in remote mode
1.1	Rear Connection	Rear communication port in use
1.2	Front Connection	Front communication port in use
2.0	Date/Time alarm	Synch. Signal not received in setting t Timeout
2.1	Serial EEPROM Alarm	Failure in serial EEPROM
2.2	Comm. Settings	Relay with factory default settings
2.3	Protection Link	Status of internal comm. with protection CPU
2.4	IRIG_B Link	Relay synchronized by IRIG_B
3.0 - 3.15		

Group	Status	Comment
4.0 - 4.15		
5.0 -5.15		

The DBF units are supplied with the following target LED's default configuration:

LED	LEFT COLUMN	LED	RIGHT COLUMN
1	TRIP STAGE 1	9	LOW SET PICKUP
2	TRIP STAGE 2	10	50BF POLE A INIT
3	PHASE A TRIP	11	50BF POLE B INIT
4	PHASE B TRIP	12	50BF POLE C INIT
5	PHASE C TRIP	13	INT. ARC A POLE
6	3P TRIP NO I	14	INT. ARC B POLE
7	INT. ARC TRIP	15	INT. ARC C POLE
8	HIGH SET PICKUP	16	REMOTE COMMUNICATIONS

2.2.4 CIRCUIT BREAKER BREAKING CAPACITY MONITORING

To supervise the breaker health, the DBF system calculates and stores, for each operation, the accumulated values of the square of the current multiplied by the opening time of the breaker (I^2t) on each phase. I^2t is expressed in kA^2 sec.

The value I^2t is accumulated and stored independently for each phase. These values can be accessed either by the local HMI or by the GE-LOCAL communications software.

The function has an *Integration Time Selector* setting (**kI²t OP MODE**) which can be used to assign a fixed opening time (given by another setting (**kI²t INT TIME**)). Otherwise the unit measures the time between the tripping signal of the main feeder protection and the change of the status contacts of the circuit breaker (52/b).

The total *Breaking Current Limit* (**kI²t LIMIT**) setting fixes the maximum life breaking capability (it is recommended to set this to the limit supplied by the manufacturer). When this threshold is reached in any phase, the system may be configured to close an output, if the appropriate internal signal (**52 A Maintenance Alarm, 52 B Maintenance Alarm, 52 C Maintenance Alarm**) is assigned to an output. In addition, the system also has a counter for the tripping operations.

The purpose of these functions is to provide accurate data to perform the circuit breaker maintenance, based on the actual breaking time and current values. Once this maintenance operation has been done, the values for both the I^2t and number of opening operations, can be reset.

In order to be able to take into account the history of the breaker, in the case where the breakers were already in use before the installation of the relay, the system allows to set an initial value for the I^2t and the number of the previous breaking operations. Similarly, these values can be adjusted to a given value in order to take into account operations carried out during protection testing.

2.2.5 BUILT-IN SELF-CHECKING UNIT

The digital technology of the DBF system allows providing a built-in self-checking function which guarantees the correct performance of the unit, and provides an external alarm in case of error detection.

Two built-in self-checking functions are performed, one when the unit is started up and the other during normal operation. Internal tests are provided for power supply, program memory (ROM), working memory (RAM), oscillography memory (RAM), and settings and calibration memory (EEPROM).

In addition, there is a hardware test for the Target LEDs, which lights them all up when the button TARGET RESET is pressed. The sealed-in targets (latched) reset if the TARGET RESET button is kept pressed during three seconds.

2.3. ANALYSIS FUNCTIONS.

The DBF system includes an event recorder and an oscillography waveform recorder with a resolution of 1 ms for the first one, and 1 sample for the second one (1.04 ms at 60 Hz and 1.25 ms at 50 Hz). To avoid the loss of date/time and oscillography records during any Vdc power failure, the unit is equipped with a capacitor, which allows the information to be kept for at least 24 hours after power loss.

2.3.1 EVENT RECORDER.

The DBF system keeps a record of the last 144 events and stores for each one the following information: date and time (accurate to one millisecond), the type of event, current RMS values during the event, and the state of the unit (set of digital signals that describes the status of the relay at any given moment in time).

This event recorder is stored in a non-volatile memory and can be maintained indefinitely, even with no power supply.

The list of events that the relay stores are factory fixed, and corresponds to standard relevant situations/operations, like **Settings Change, Program initiate, Active Table 1, Opening 52 phase C, Closing 52 phase C, Digital Input 1 Activated,** etc.

2.3.1 OSCILLOGRAPHY

The DBF unit stores up to 4 oscillography records, with a resolution of 16 samples per cycle. Each record has a maximum capacity of 66 cycles. The number of pre-fault cycles can be selected from 2 to 10 cycles. Each record includes the following information:

- Date and time.
- Name of the signal that triggered the oscillography.
- Active settings table when recording
- Digital information (Status of internal digital signals)
- Instantaneous rms values of currents (I_A, I_B, I_C and I_N)

A configurable *mask* is available for selecting which functions or internal signals are able to trigger the oscillography. It can either be triggered by a configurable digital input, by a command received from the communication program (GE_LOCAL), or directly from the HMI.

The user can select from the following list which signals may trigger the oscillography:

Events to Trigger the Oscillography
PICKUP
1ST STAGE TRIP
2ND STAGE TRIP
INTERNAL ARC
50BF A TRIP
50BF B TRIP
50BF C TRIP
50BF 3P TRIP
EXTERNAL TRIGGER
COMM. TRIGGER
HI-SET A PICKUP
HI-SET B PICKUP
HI-SET C PICKUP
50BF A INIT
50BF B INIT
50BF C INIT
LO-SET A PICKUP
LO-SET B PICKUP
LO-SET C PICKUP
3 POLE 50BF INIT
NEUTRAL PICKUP
ARC A PICKUP
ARC B PICKUP
ARC C PICKUP

The oscillography records are retrieved from the relay to the computer in **COMTRADE** international standard format using the GE_LOCAL communications program. To draw the waveforms, digital flags, phasors and post-fault analysis in general, it is suggested to use the GE_OSC oscillography program or any other that accepts **COMTRADE** international format (IEEE-C37.111-1991). It is also possible to import the waveforms with mathematical or spreadsheet programs (for example EXCEL™).

2.4. CONTROL

2.4.1 TABLES OF SETTINGS

The DBF system has two types of settings stored in non-volatile memory (information is kept even when there is no auxiliary voltage):

- Generic Settings.
- Specific Settings.

The ***Generic*** settings are grouped as follows:

GENERAL SETTINGS
BREAKER SETTINGS
ACTIVE TABLE SETTINGS
OSCILLOGRAPHY MASK
FUNCTION PERMISSION

For the ***specific*** settings, the DBF allows to have up to 3 independent setting tables. These specific settings are grouped as follows:

50BF SETTINGS
INTERNAL ARC SETTINGS

Only one setting table is active at a given time, and this is the table used by the system to run the different functions included in it.

There is an "ACTIVE TABLE" setting that determines the settings table that is active at a given moment.

The active settings table can be changed by means of up to 2 digital inputs, referred to as "ACTIVE TABLE SELECT 0" and "ACTIVE TABLE SELECT 1" which allow up to 4 combinations from 0 to 3. To do this it is necessary to configure (using GE-INTRO software) two inputs to have these meanings. For applications which require less tables (up to 2) it is possible to use only one input.

The selected combination is obtained from the binary coding of the 2 inputs mentioned (see following table). The 0-0 means selecting the table indicated in the "ACTIVE TABLE" setting, and numbers 0-1 to 1-1 select tables 1 to 3 respectively

Table Selection INPUT-1	Table Selection INPUT-0	Active Table
0	0	Selected by setting
0	1	1
1	0	2
1	1	3

NOTE: if the inputs are programmed and used, energizing them, this selection has priority over the "ACTIVE TABLE" setting and the table which is in fact used is determined by the status of the digital inputs.

2.4.2 TIME SYNCHRONIZATION.

The DBF system includes an input for time synchronization. This input requires the connection of a device to supply a demodulated IRIG-B output. In this way coordinated universal time is measured to a high degree of accuracy and makes possible to tag events generated by the unit with a resolution of one millisecond.

The use of this input makes it possible to correlate data obtained from different units thanks to synchronization with GPS satellites. In this way it is possible to obtain very useful information for analysis, cross-referencing the information provided by different units for a given incident.

Alternatively, it is possible to synchronize units by means of communications, using the GE-LOCAL communications software, or manually by means of the HMI. If the IRIG-B input is used it has priority over time setting by communications, since the time read by IRIG-B is much more accurate.

2.4.3 CONFIGURABLE INPUTS AND OUTPUTS

2.4.3.1 Digital Inputs

The DBF system has 6 digital inputs (two groups of 3 inputs with one common in each group). The inputs can be configured by the user by means of the GE-INTRO configuration program. Using the optional expansion board it is possible to increase the number of inputs up to a total of 14 (2 groups of 3 inputs with one common in each group and 4 groups of 2 inputs with one common in each group). See the external connections diagram for additional reference.

One of the following meanings can be assigned to any input: (For more detail about the configuration of the inputs, see GE-INTRO Instruction Book).

Function	P/L
Unused input	
50BF Initiate A	L
50BF Initiate B	L
50BF Initiate C	L
3P BF Initiate	L
52a pole A	L
52a pole B	L
52a pole C	L
52b pole A	L
52b pole B	L
52b pole C	L
Latching Relays Reset	P
External Trigger	P
Active Table Select 0	L
Active Table Select 1	L

(L) indicates Level input
(P) indicates Pulse input

2.4.3.2 Outputs

The basic DBF system has 10 outputs as follows:

- 2 tripping contacts (A12-B12 and C1-D1)
- 1 Breaker failure pickup signaling (A11-B11)
- 1 Internal arc detection (C2-D2)
- 1 Equipment alarm (C3-D3)
- 5 configurable contacts (C4-D4 to C8-D8)

The optional expansion board for the DBF provides 6 additional latched contacts (E1-F1 to E6-F6). This outputs are not configurable and are assigned as follows:

- 3 tripping contacts (TRIP 1st Stage) (E1-F1 to E3-F3)
- 3 tripping contacts (TRIP 2nd Stage) (E4-F4 to E6-F6)

The configurable outputs can be programmed using logic based on the internal protection states (pick-ups, trips, alarms, etc.). The DBF has 66 different internal states, and these can be used to carry out logical operations NOT, AND and OR, which gives the unit a great flexibility.

The output configuration is done using different levels. At the first level it is possible to use AND gates of up to 16 signals. The output is incorporated into the states matrix so that it can then be used in other AND gates of up to 16 inputs. This process can continue until the 16 ANDs are used.

Once the AND gates have been configured it is possible to create a second level with OR gates of 16 inputs limited to the established groups of bytes, and whose logical outputs are assigned to physical outputs of the unit. This means that we can configure the physical outputs with any internal signal from the status or any combination of them made by means of the AND logic gates.

2.5. MAN-MACHINE INTERFACE (HMI)

The DBF system includes as standard a 20 key keyboard and a 2-line liquid crystal display (LCD) with 16 characters per line. This display has highly reliable LED diode back lighting (the screen brightness can be adjusted on the rear of the front board).

By means of this interface the user can change the settings, display measurements, carry out operations and access information stored in the unit. The functions of this local interface and how to use it are described in the section KEYBOARD AND DISPLAY.

2.6. REMOTE COMMUNICATIONS

The relay has 2 serial gates and three connectors. Gate 1 can be reached from the front of the relay in connector 1 (PORT 1 connector) or from the rear (PORT 2 connector). The second gate can be reached from connector 3 (PORT 3 connector) which is located on the rear.

There are different models, each with a different physical connection for the PORT 3 connector (RS-232/RS-485 or fiber-optic). In the "RS232" models the three connectors are RS232. In the "RS232 and fiber-optic" models the PORT1 and PORT2 connectors are RS232 while the PORT3 connector is replaced by a fiber-optic connector.

The PORT 1 connector has priority over the PORT 2 connector and is selected when the DCD (Data Carrier Detect) signal is activated. Figure 8 shows how to make the connections to a personal computer.

Gate 1 (PORT 1 and PORT 2 connectors) and 2 (PORT 3 connector) are independent and the unit can serve them simultaneously.

The communications protocol is the same used for the rest of the GE digital protection systems and requires the use of the GE-LOCAL software. PORT 3 protocol can be chosen between M-LINK and ModBus RTU. The protocol is highly reliable and allows communication with different protection systems. It guarantees very efficient data transfer (especially for the oscillography and other large files) along with error detection and automatic communication recovery.

The status of the local/remote communication is indicated on the front of the unit by LED indicator 16 (the last LED in the right-hand column, according to the default configuration.) Local communication refers to communication via the keyboard/display (local display showing any information except for the initial DBF GENERAL ELECTRIC screen), or via communications gate 1 (PORT 1, PORT2 connectors), and remote communication refers to connection via gate 2 (PORT 3 rear connector).

Local and remote communications can exist at the same time, although there is only one possibility for changing settings and carrying out operations, since this can only be done with the communication which has priority (local communication) while the other is limited only to accessing information. When the local communication is interrupted, either by the disconnection of PORT 1 connector or because the HMI is on the initial screen (a situation which can be caused intentionally, or automatically if no key has been pressed for 15 minutes), the remote communication recovers the ability to modify settings and carry out operations.

3. SETTINGS

This section describes the settings of the DBF relay and the procedure to modify them. Table 3 shows the list of DBF settings, their range and resolution, and the factory default settings.

To view or to modify settings using the GE_LOCAL program connected to PORT 1, PORT 2 or PORT 3 the user has to perform the following steps:

- Check that the available connection cable is in accordance with the diagram in Figure 7. Check correspondence between DB-9 connector in the cable with available connector at PC port (could be DB-9 or DB-25)
- Connect the cable between the relay (or modem) and the serial port of your computer.
- Run the GE-LOCAL software. For more details on the installation and use of the GE-LOCAL software see instruction book GEK-105568.
- Make sure that the communication parameters in GE_LOCAL match with those set on the DBF. Specifically, the parameters on the configuration of the local HMI are:

  * *COMMUNICATION SPEED*: On the relay depending on whether communication is: through PORT 1 or PORT 2 (means **LOCAL**), or PORT 3 (means **NET**)
  * *STOP BIT*: Stop-bit corresponding to each one of the communication ways: LOCAL or NET

To modify or view the DBF communication parameters refer to Chapter 8, Section 8.1 **"Menu Tree".**

IMPORTANT: It should be noted that in order to simplify the setting of the unit and for safety reasons, all settings related with the configuration of the unit (configurable inputs and outputs, internal status events and target LED's) have been removed from the HMI facilities and also from the communications software **GE_LOCAL**. To perform these configurations the **GE_INTRO** software (described in instruction book GEK-105569) must be used.

TABLE 3. Settings Table

Common to all tables	Range	Default	Step
General Settings Group			
Relay status	In/out of service	In-service	
Identification	20 ASCII characters	No ID	
Frequency	50 / 60 Hz	50 Hz	
Phase CT Ratio	1-4000	1	1
Neutral CT Ratio	1-4000	1	1
Breaker Setting Group			
Breaker Number	4 ASCII characters	0000	
kI^2t Operation Mode	Fixed-Measured	Fixed	
Integration Time for kI^2t	0.03-0.25s	0.06s	0.01s
kI^2t Maximum Limit	1-999999	99999	1
Active table setting group			
Active setting table #	1 - 3	1	1

Common to all tables	Range	Default	Step
Oscillography Mask			
Prefault Cycles	2-10	4	1
Arc Detection	Enable-Disable	Enable	
Pickup	Enable-Disable	Enable	
1st Stage trip	Enable-Disable	Enable	
2nd Stage Trip	Enable-Disable	Enable	
50BF A Trip	Enable-Disable	Enable	
50BF B Trip	Enable-Disable	Enable	
50BF C Trip	Enable-Disable	Enable	
50BF 3P Trip	Enable-Disable	Enable	
External Trigger	Enable-Disable	Enable	
Communications Trigger	Enable-Disable	Enable	
Hi-Set A Pickup	Enable-Disable	Enable	
Hi-Set B Pickup	Enable-Disable	Enable	
Hi-Set C Pickup	Enable-Disable	Enable	
50BF A Init.	Enable-Disable	Enable	
50BF B Init.	Enable-Disable	Enable	
50BF C Init.	Enable-Disable	Enable	
Lo-Set A Pickup	Enable-Disable	Enable	
Lo-Set B Pickup	Enable-Disable	Enable	
Lo-Set C Pickup	Enable-Disable	Enable	
3P 50BF Init.	Enable-Disable	Enable	
Neutral Pickup	Enable-Disable	Enable	
Arc A Pickup	Enable-Disable	Enable	
Arc B Pickup	Enable-Disable	Enable	
Arc C Pickup	Enable-Disable	Enable	

Functions Permitted			
50BF 1P function	Permitted-Non-Permitted	Non-Permitted	
50 BF 3P Function	Permitted-Non-Permitted	Non-Permitted	
3P No I Function	Permitted-Non-Permitted	Non-Permitted	

Independent for each table	Range	Default	Step
50BF Settings			
PH Hi-Set Pickup	1-12A	2A	0.01A
PH Lo-Set Pickup	1-12A	1A	0.01A
Neutral Pickup	0.50-6A	1A	0.01A
1 Phase Timer T1	0.05-2s	0.5s	0.01s
3 Phase Timer T2	0.05-2s	1s	0.01s
3P No I Timer T3	0.05-2s	2s	0.01s
BF Logic (3P/2P)	2-Phases/3 Phases	2-Phases	
Severe Fault 3P	Permitted-Non-Permitted	Non-Permitted	
Low Load 2P	Permitted-Non-Permitted	Non-Permitted	
Output Stages number	1-2	1	1
2nd Stage Timer	0.05-2s	2s	0.01s

Internal Arc Settings			
Internal Arc Pickup	0.05-1A	1A	0.01A
Internal Arc Timer	0.10-2s	1s	0.01s

COMMENTS ON SETTINGS:

1. The **Identification** setting allows the user to input a name for the unit (for example the name of the line or feeder) with a maximum of 20 ASCII characters.

2. The **Active Table** setting allows selecting the table to be active during normal operation among the three tables available on the DBF. This selection can also be done by means of digital inputs configured for this purpose. The table input selection has priority over the table setting selection (if the input has been configured to perform change of tables).

3. To set the breaker monitoring function it is necessary to set first the **kI^{2}t OP. Mode** setting. If this is selected as "measured" no other setting is required, since the time used for the calculation is the time taken by the unit during the interval: trip order-52/b contact to close. If the “fixed” mode is selected it is necessary to set then the **kI^{2}t Integration Time**. In this case the time used will be always the set time (should be the rated operating time of the circuit breaker provided by the manufacturer).

4. The **Pre-Fault Cycles** to be shown in every oscillography record may be adjusted from two to ten (2-10). In any case the total number of cycles for any oscillography record is 66, regardless of pre-fault cycles setting.

5. The difference between the function permission and permitted trips settings is:

    - The function permission setting enables or disables the function
    - The trip permission setting allows to enable or disable any specific function to trip, but keeping always active the function, providing thus capability to generate events, alarms and signals.

6. The overcurrent ranges shown in Table 3 correspond to models of 1-12A for phase and 0.5-6A for ground for 5A rated CT’s. Only **PH Lo-Set Pickup, PH Hi-Set Pickup** and **Neutral Pickup** settings change with the range.

7. Sometimes the names used to describe the settings for both the local HMI and the communications program are short or abbreviated. This is because of the space limitation imposed by text windows in the program.

4. TECHNICAL CHARACTERISTICS

4.1. MODEL LIST

Position	DBF	1	-	-	-	-	1	1	-	-	0	0	A	Description
5														**Comm. Interface**
			0											P2: RS232 + P3: RS232
			1											P2: RS232 + P3: Plastic F.O.
			2											P2: RS232 + P3: Glass F.O.
			3											P2: RS232 + P3: RS485
6														**Ranges**
				[1]										See Table [1R]
7														**Comm. Protocols**
					1									P1, P2, P3: Mlink
					2									P1, P2: Mlink; P3: ModBus
8														**Language**
						M								Spanish
						D								English
11														**Model**
									0					Basic Model
									1					Enhanced Model (Expansion board)
12														**Power Supply**
										G				48-125 VDC
										H				110-250 VDC
13,14											**0**	**0**		**Special Models**
15													**A**	**Revision**

TABLE [1R] - RANGES								
MODELS		**A**	**B**	**C**	**D**	**E**	**F**	**G**
DBF	**PHASE**	1-12 A	0.2-2.4 A	1-12A	1-12 A	1-12 A	0.5-6 A	0.5-6 A
	GROUND	1-12 A	0.2-2.4 A	0.2-2.4 A	0.5-6 A	0.1-1.2 A	0.2-2.4 A	0.1-1.2 A

4.1.1. SPECIAL MODELS

The input voltage of the standard model corresponds to the Power Supply voltage. The following models have been developed to allow the selection of an input voltage independently of the Power Supply.

The following codes should be placed as two last digits before **A** in the ordering code for selecting the desired characteristics:

MOD 04: V inputs: 48 Vdc ±20%
MOD 05: V inputs: 110 Vdc ±20%
MOD 06: V inputs: 125 Vdc ±20%
MOD 07: V inputs: 250 Vdc ±20%

Example: If we want to order a relay model with a digital input voltage of 48 Vdc, the model should be: DBF1*****11**04A.

4.2. TECHNICAL CHARACTERISTICS

MECHANICAL

- Metal 19” rack case, 2 units high
- IP51 Protection (as per IEC 529)
- Local HMI: LCD (2 rows, 16 characters) and 20 key keyboard
- Rear connection for wiring: 4 blocks, 12 terminals each (6 blocks when optional expansion board)
- Dimensions: 437 x 164 x 88 mm
- Weight: Net 6 kg. Shipping 7 kg.

ELECTRICAL

• Frequency:	50 or 60 Hz (selectable by setting)
• Rated current:	1 or 5 A (different models)
• DC Power Supply	48/125 Vdc or 110/250 Vdc (different models)
• Operational range	80% to 120% of rated values
• Digital Input Voltage	For standard models: 48-125, 110-250 VDC (according to selected model). For special models, please refer to section 4.1.1.
• Thermal Capacity	
Current circuits	
- Permanent	4 x In
- 3s duration	50 x In
- 1 s duration	100 x In
• Temperature ranges	
-Operation	-20º C to + 55ºC
-Storage	-40ºC to + 70ºC
• Humidity	Up to 95% without condensation
• Trip contacts:	
AC	
-Continuous Capacity	16A
-Rated Breaking Capacity	4000VA
-Make	25A for 4 sec
-Operating Time	8 ms or less
DC Breaking Capacity	
- Resistive	9A at 30V
- Resistive	0.65A at 100V
- Inductive(L/R=40 ms)	0.5A at 30V
• Burden	
-Current circuits	0.5 VA at I_r = 5 A 0.1 VA at I_r = 1A
• Consumption:	
-At DC rated voltage	12 W idle state 16 W all relays activated
-Digital inputs	8 mA (1 W at V_{rated} = 125 VDC)
• Accuracy	
-Current	5%
-Time	5% or 30ms (whichever is greater)
- Error index	Class E-5 as per IEC 255-4
• Repeatability	
-Operating value	1%
-Operating time	2% or 30 ms (whichever is greater)

COMMUNICATIONS

-RS232 using DB9 female connector (2/3 connectors depending on model)

- Mode: Half duplex

-1 mm plastic fiber-optic (depending on model)

Typical power output :	-8dBm
Receiver sensitivity	-39dBm
Numeric aperture N.A.	0.5
Wave length	660 nm (visible red)
HFBR-4516 type connector	

-Glass fiber-optic 62.5/125 (depending on model):

Typical power output:	-17.5 dBm
Receiver sensitivity	-25.4 dBm
Numeric aperture N.A.	0.2
Wave length	820 nm (near infrared)
SMA type connector	

STANDARDS

The DBF system complies with the following standards, which include the GE insulation and electromagnetic compatibility standard and the standards required by Community Directive 89/336 for the EC market, in line with European standards. It also complies with the European directive requirements for low voltage, and the environmental and operating requirements established in ANSI standards C37.90, IEC 60255-5, IEC 60255-6 and IEC 68.

Test	Standard	Class
Insulation test voltage	IEC 60255-5 50/60 Hz 1 min.	600V, 2kV
Impulse voltage	IEC 60255-5	5kV,0.5 J
1 MHz interference	IEC 60255-22-1	III
Electrostatic discharge	IEC 60255-22-2 EN 61000-4-2	IV 8kV
Immunity to radio interference	IEC 60255-22-3	III
•Electromagnetic fields radiated with amplitude modulation	ENV 50140	10 V/m
•Electromagnetic fields radiated with amplitude modulation. Common mode	ENV 50141	10 V/m
•Electromagnetic fields radiated with frequency modulation	ENV 50204	10 V/m
•Fast transients	IEC 60255-22-4 EN 61000-4-4	IV
•Magnetic fields at industrial frequency	EN 61000-4-8	30 Av/m
•RF emission	EN 55011	B

5. HARDWARE DESCRIPTION

CAUTION

The DBF contains electronic components that can be damaged by electrostatic discharge if currents flow through some terminals of the internal components. The main source of electrostatic discharge currents is the human body, especially in conditions of low humidity, carpeted floors and isolated footwear. Under these conditions it is important to have special care when removing and handling the modules or some of their internal components. Personnel handling the relay should check that their body is free from electrostatic charge, either by touching a surface at ground potential or by using an electrostatic wristband connected to earth.

5.1. PHYSICAL DESCRIPTION

5.1.1. CASE

The DBF case is made of stainless steel and consists of the main body and a covering lid. The main body of the case contains the blocks of terminals necessary to carry out the external connections and guides to support the trays that contain the internal parts of the relay. The trays can be pulled out in order to make easy the maintenance and servicing of the relay.

5.1.2. ELECTRICAL CONNECTIONS

All the electrical connections for current channels, digital input and output relays are made using the terminal blocks fixed to the rear part of the case. The connections required for communications are made using three DB-9 serial connectors, one on the front and two on the rear when using communication option RS-232. One of these connectors is replaced by the corresponding fiber-optic connector in models including this option.

5.1.3. INTERNAL CONSTRUCTION

Internally the DBF unit is divided into 2 trays and a case. The case with the blocks of terminals is described above.

The lower tray carries the magnetic module and a printed circuit board which contains the power supply, the digital inputs and also the trip outputs and auxiliary outputs on the basic version (model without expansion board).

The upper tray carries the board with the protection system CPU and the communications. This tray can also carry as an option the input and output expansion board.

The front panel consists of a covered keyboard and a board which carries the alphanumeric display, the LEDs and the Reset button. The model number (see list of models in Chapter 4) and the technical characteristics of the unit are situated on the front panel of the relay.

The 16 indicator LEDs can be identified using labels which can be placed beside them, inside available plastic holders.

A frontal bus is responsible for the connections between the lower and upper trays described above. Both trays can be pulled out. To do so you first have to release the front panel which is fixed to the case with two screws and pull it out, removing the flat cable which connects it to the CPU. It is then possible to remove the frontal bus.

The blocks of terminals situated on the rear of the case are identified with the letters A, B, C and D, and optionally E and F, as shown in figure 9. In addition, each terminal is identified with a number.

The communications connectors are situated on left-hand side of the front and on the right-hand side of the rear of the case. The front port is PORT 1 and the rear ports are PORT 2 and PORT3. The IRIG-B connection is made using a block of two additional terminals.

5.2. OPERATING THEORY

The DBF unit measures current signals, performs complex calculations using internal data, stores relevant incidents, pick-up tripping relays and generates information that can be used to determine the state of the associated electrical system. The DBF functionality is related to the following modules:

- Magnetic module
- CPU board
- Power supply
- Keyboard and display

5.2.1. MAGNETIC MODULE

The magnetic module performs two essential functions: galvanic insulation and scaling analog input signals. In the case of current transformers the input current for the primary winding is converted into a scaled voltage in the secondary winding. Each current transformer must be linear in the whole measurement range of the relay.

5.2.2. CPU BOARD

The DBF uses two 16-bit microprocessors operating at a clock frequency of 20 MHz. One of these microprocessors is used to perform the relay communications and the other performs the necessary calculations for protection functions. In general the microprocessors are responsible to perform the input and output calculations and operations at very high speed. The use of two microprocessors is especially recommendable to make the protection and communication functions independent of each other inside the unit itself, and therefore increase the reliability of the system.

The analogue-digital converter converts the voltage inputs into their digital equivalent with a resolution of 10 bits.

The unit code is stored in non-volatile EPROM memory while the settings and events are stored in EEPROM memory. The data related to the oscillography is stored in RAM memory which is maintained using a capacitor, thus avoiding the loss of information when the unit is disconnected.

A high-resolution real time clock is used to ensure that the date and time of all incidents can be time-tagged, with a resolution of one millisecond. This clock can be synchronized externally using an IRIG-B demodulated signal..

The input and output functions are divided between the two microprocessors. The serial ports, the keyboard and the display are controlled by the communications microprocessor. External communications are processed by a serial communications controller circuit which contains a universal asynchronous transceiver (DUART). The digital inputs and outputs are processed by the protection microprocessor.

The DBF contains 6 independent circuits to process digital inputs. These circuits check the presence or absence of input voltage and are designed to isolate them electrically from the microprocessor, thus increasing the reliability of the system.

On the front of the relay there is a set of 17 Target LED's, one of which is fixed and indicates the operating state of the unit. The rest are user-configurable using **GE_INTRO** software.

The button situated on the front is designed to check the state of the Target LED's and to reset them by keeping it pressed during 3 seconds.

5.2.3 POWER SUPPLY

The DBF power supply can be 48-125 VDC or 110-250 VDC rated. The operating margin of the power supply is ± 20%, and is galvanically isolated from the rest of the relay's circuits. The power supply provides ± 12 VDC to the analog circuitry and the output relays, and ± 5 VDC for the digital circuits.

5.2.4 KEYBOARD AND DISPLAY

The DBF display at the front of the relay is liquid crystal type and consists of two rows of 16 characters each. The display has background light with variable lightness adjustable by a potentiometer located on the rear of the front cover plate.

6. ACCEPTANCE TESTS

6.1. CONNECTIONS AND NECESSARY EQUIPMENT

Necessary equipment:

- One current source
- One DC voltage source
- Precision timer for testing timed events
- One AC/DC voltmeter/ammeter

Connect the relay as indicated in the external connections diagram, Figure 2.

For safety reasons, the external protection earth should be securely grounded.

Apply dc rated voltage to terminals A10-B10

6.2. VISUAL INSPECTION

Check that the relay has not suffered any kind of damage due to transport and handling.

Check that all the screws are tight and the terminal blocks have not been damaged in any way.

6.3. PANEL INSULATION TESTS

If any insulation test would be performed on the panel where the relay is installed, the ground terminals A9-B9 must remain ungrounded.

Do the following groups in the terminals of the relay:

Group 1: A10, B10
Group 2: A1 to A4, B1 to B4
Group 3: C9, C10, D9, D10, C11, C12, D11, and D12
Group 4: A11, B11, A12, and B12
Group 5: C1, D1, C2, D2, C3, and D3
Group 6: C4, C5, C6, C7, C8, D4, D5, D6, D7, and D8

If the relay has expansion board, then the following groups must be added:

Group 7: E7, F7, E8, F8, E9, F9, E10, F10, E11, F11, E12, and F12
Group 8: E1, F1, E2, F2, E3, F3, E4, F4, E5, F5, E6, and F6

Apply 2000V gradually between case and groups.

Apply 2000V gradually between groups.

6.4. RELAY SETTING

Introduce the following settings in the relay (by means of HMI or GE_Local software):

General Settings Group	Value
Relay Status	IN SERV
Identification	N/A
Frequency	50 Hz / 60 Hz
Phase CT Ratio	1
Neutral CT Ratio	1
Breaker Settings	**Value**
Breaker Number	N/A
KI2t Op. Mode	Fixed
KI2t INT. Time	0.06s
KI2t LIMIT	99999
Active Table Set	**Value**
Active Table	1
Function Permit	**Value**
50BF 1P Function	No Per
50BF 3P Function	No Per
3P NO INT Funct	No Per
50BF Settings Table 1	**Value**
PH Hiset Pickup	2A
PH Loset Pickup	1A
Neutral Pickup	1A
1 Phase Timer T1	1s
3 Phase Timer T2	1s
3P No I Timer T3	2s
BF Logic (3p/2P)	2 PHASE
Severe Fault 3P	Per
Low Load 2P	No Per
Nº Output Stages	1
2nd Stage Timer	2s
Internal Arc Settings Table 1	**Value**
Int Arc Pickup	1A
Int Arc Timer	1s

The specific settings required for each test are indicated; other settings do not affect the tests.

6.5. INDICATORS

Check that pressing the TARGET RESET button (with relay fed with rated dc power supply) all target LEDs light up.

6.6. POWER SUPPLY

The relay operates with a dc power supply within ± 20% of the rated value. Check that the READY target LED in the front of the relay lights up showing green color.

1. Apply dc rated voltage to terminals A10-B10
2. Change setpoint FUNCTION PERMIT/50BF 1P FUNCTION to PERM.
3. Apply 2A to terminals A1-A2.
4. Energize digital input CC1 PHASE A BF INITIATE (C9-D10).
5. Wait 1second.
6. Check that the READY target LED in the front of the relay lights up showing green color.
7. Check the dc burden (see table below)

8. Remove the current from terminals A1-A2. Remove voltage from digital input CC1.
9. Repeat these steps with minimum and maximum voltages depending on the range of the relay.

Test voltages and typical burdens are listed below:

Model "G" (48/125 VDC)

	DC Battery (mA)	
Voltage (Vdc)	**Without Expansion Board**	**With expansion Board**
38	340	440
125	250	320
150	225	300

Model "H" (110/250 VDC)

	DC Battery (mA)	
Voltage (Vdc)	**Without Expansion Board**	**With expansion Board**
88	300	370
110	250	320
300	150	220

6.7. COMMUNICATIONS

The object of this test is to check the communication ports of the relay (PORT1, PORT2 and PORT3). To do this it is necessary to use a computer and the communications software GE_LOCAL. Figure 7 shows the series cable and connection accessories necessary to establish the connection between the PC and the relay. Figure 8 shows the cable and connectors necessary for remote connection (by MODEM) through PORT3.

The PC communication parameters necessary to match the relay default setting parameters are:

Relay number: 1
Remote port speed: 19200
Local port speed: 19200
Remote stop bit: 1
Local stop bit: 1

By using GE_Local communications software establish the connection and check that the relay communicates through the three communication ports. Repeat this test with different baud rates and different power supply voltages.

6.8. INPUTS

6.8.1 DIGITAL INPUTS

Log into the relay using the GE_LOCAL software and press INPUTS / OUTPUTS button on the first general screen.

- Check that applying dc rated voltage between terminals:

C9	and	D10	(CC1)
D9	and	D10	(CC2)
C10	and	D10	(CC3)
C11	and	D12	(CC4)
D11	and	D12	(CC5)
C12	and	D12	(CC6)

their corresponding status windows turn red while the applied voltage remains present.
If the relay has the optional expansion board, check the same for the following contact converter inputs:

E7	and	E8	(CC7)
F7	and	E8	(CC8)
E9	and	F8	(CC9)
F9	and	F8	(CC10)
E10	and	E11	(CC11)
F10	and	E11	(CC12)
E12	and	F11	(CC13)
F12	and	F11	(CC14)

6.8.2 IRIG-B SYNCHRONIZING INPUT

Connect the output of an IRIG-B unit with decoded output to the IRIG-B input at the rear of the DBF. Special care must be taken when making the connection because the input is polarized.
Check that the time measured by the two units is the same.

6.9. FUNCTIONS

6.9.1 50BF 1P UNIT TEST

1. Change setpoint GENERAL/FUNCTION PERMIT/50BF 1P FUNCTION to PER.
2. Change setpoint GENERAL/FUNCTION PERMIT/50BF 3P FUNCTION to NO PER.
3. Change setpoint TABLE 1/FUNCTION PERMIT/3P No INT FUNCT to NO PER.
4. Change setpoint 50BF SETTINGS/Nº OUTPUT STAGES to 2.
5. The precision timer will be started at the same time than the corresponding contact converter (digital input) is energized. The timer stop input will be wired to any DBF contact under test, i.e. contact C4-D4.
6. Apply 2A to terminals A1-A2 (phase A).
7. Energize digital input CC1 PHASE A BF INITIATE (terminal C9-D10).
8. Check that after T1 time delay (1s), the following contacts are closed:

   A12-B12

   C4-D4

   C5-D5

In case the relay under test includes an expansion board, check also the operation of the following contacts:

E1-F1

E2-F2

E3-F3

9. Check that after 2nd Stage Timer delay (2s), the following contacts are closed:

   C1-D1

   C6-D6

   C7-D7

and if the relay is equipped with an expansion board also the following contacts must be closed:

E4-F4

E5-F5

E6-F6

10. Repeat steps 7, 8, 9 and 10 using phase B current (B1-B2 terminals) and CC2 PHASE B BF INITIATE (D9-D10 terminals) to start the breaker failure operation.
11. Repeat steps 7, 8, 9 and 10 using phase C current (A3-A4 terminals) and CC3 PHASE C BF INITIATE (C10-D10 terminals) to start the breaker failure operation.
12. Change setpoint TABLE 1/50BF SETTINGS/Nº OUTPUT STAGES to 1.
13. Repeat steps 7 to 12 to check that in this case contacts C1-D1, C6-D6, C7-D7, E4-F4, E5-F5 and E6-F6 close at the same time than contacts: A12-B12, C4-D4, C5-D5 and E1-F1, E2-F2, E3-F3 (if an expansion board is available).

6.9.2 50BF 3P UNIT TEST

The DBF relay outputs are factory set with the default settings shown in the external connections drawing (Figure 2).

1. Change setpoint GENERAL/FUNCTION PERMIT/50BF 1P FUNCTION to NO PER.
2. Change setpoint GENERAL/FUNCTION PERMIT/50BF 3P FUNCTION to PER.
3. Change setpoint GENERAL/FUNCTION PERMIT/3P No INT FUNCT to NO PER.
4. Change setpoint TABLE 1/50BF SETTINGS/Nº OUTPUT STAGES to 2.
5. Change setpoint TABLE 1/50BF SETTINGS/BF Logic (3P/2P) to 3 PHASE.
6. The precision timer will be started at the same time than the corresponding contact converter (digital input) is energized. The timer stop input will be wired to any DBF contact under test, i.e. contact C4-D4.
7. Apply 3A to terminals A1-A2 (phase A), B1-B2 (phase B) and A3-A4 (phase C).
8. Energize digital input CC7 3 POLE BF INITIATE (if the relay has not an expansion board, energize digital inputs CC1 PHASE A BF INITIATE and CC2 PHASE B BF INITIATE simultaneously).
9. Check that after T2 time delay (1s), the following contacts are closed:

   A12-B12

   C4-D4

   C5-D5

10. Check that after 2nd Stage Timer delay (2s), the following contacts are closed:

    C1-D1

    C6-D6

    C7-D7

11. Change setpoint TABLE 1/50BF SETTINGS/Nº OUTPUT STAGES to 1.
12. Repeat steps 8 to 9. Check that after T2 time delay (1s), all the contacts are closed:

A12-B12	C1-D1
C4-D4	C6-D6
C5-D5	C7-D7

13. Change setpoint TABLE 1/50BF SETTINGS/BF LOGIC (3P/2P) to 2 PHASE.
14. Apply 3A to terminals B1-B2 (phase B) and terminals A3-A4 (phase C).
15. Energize digital inputs CC2 PHASE B BF INITIATE and CC3 PHASE C BF INITIATE.
16. Check that after T2 time delay (1s), the following contacts are closed:

A12-B12	C1-D1
C4-D4	C6-D6
C5-D5	C7-D7

17. Repeat steps 15 to 17 choosing any other pair of phases to apply ac current and any other pair of BF initiation inputs.

6.9.3 INTERNAL ARC TEST

1. Change setpoint GENERAL/FUNCTION PERMIT/50BF 3P FUNCTION to NO PER.
2. Change setpoint TABLE 1/INTERNAL ARC SETTINGS/INT ARC TIMER to 2s.
3. Energize digital input CC4 52/b A
4. Apply 2A to terminals A1-A2 (phase A).
5. Check that after INT ARC TIMER time delay, contact C2-D2 is closed.
6. Repeat steps 3, 4 and 5 for phases B (terminals B1-B2) with digital input CC5 52/b B and C (terminals A3-A4) with digital input CC6 52/b C.

6.9.4 3P NO I FUNCTION

1. Change setpoint GENERAL/FUNCTION PERMIT/50BF 1P FUNCTION to NO PER.
2. Change setpoint GENERAL/FUNCTION PERMIT/50BF 3P FUNCTION to NO PER.
3. Change setpoint GENERAL/FUNCTION PERMIT/3P No INT FUNCT to PER.
4. Change setpoint TABLE 1/50BF SETTINGS/Nº OUTPUT STAGES to 1
5. Change setpoint TABLE 1/50BF SETTINGS/ 3P NO I TIMER T3 to 1s
6. Change setpoint TABLE 1/50BF SETTINGS/LOW LOAD 2P to PER.
7. Energize digital input CC7 3P BF INITIATE. If the relay has not an expansion board, energize CC1 PHASE A BF INITIATE and CC2 PHASE B BF INITIATE.
8. Check that after 3P NO I TIMER T3 (2s), the following contacts are closed:

C4-D4	A12-B12
C5-D5	C1-D1
C6-D6	C7-D7

9. If the relay is provided with an expansion board, check that also the following contacts are closed:

E1-F1	E2-F2
E3-F3	E4-F4
E5-F5	E6-F6

6.9.5 NEUTRAL OVERCURRENT UNIT TEST

1. Change setpoint GENERAL/FUNCTION PERMIT/50BF 1P FUNCTION to NO PER.
2. Change setpoint GENERAL/FUNCTION PERMIT/50BF 3P FUNCTION to NO PER.
3. Change setpoint GENERAL/FUNCTION PERMIT/3P No INT FUNCT to PER.
4. Change setpoint TABLE 1/50BF SETTINGS/LOW LOAD 2P to PER.
5. Energize digital inputs CC4, CC5 and CC6 (52b inputs).
6. Energize digital inputs CC7 3P BF INITIATE. If the relay has not an expansion board, energize digital inputs CC1 PHASE A BF INITIATE and CC2 PHASE B BF INITIATE.
7. Apply 2A to terminals B3-B4 (neutral).

8. Check that after 3P NO I TIMER T3 (2s), the following contacts are closed:

A12-B12	C1-D1
C4-D4	C6-D6
C5-D5	C7-D7

9. If the relay is provided with an expansion board, check that also the following contacts are closed:

E1-F1	E2-F2
E3-F3	E4-F4
E5-F5	E6-F6

6.10. RELAY MEASUREMENT TESTS

6.10.1. CURRENT MEASUREMENT

1. Change setpoint GENERAL/FUNCTION PERMIT/50BF 1P FUNCTION to PER.
2. Change setpoint GENERAL/FUNCTION PERMIT/50BF 3P FUNCTION to NO PER.
3. Change setpoint GENERAL/FUNCTION PERMIT/3P No INT FUNCT to NO PER.
4. Change setpoint TABLE 1/50BF SETTINGS/PH LOSET PICKUP to 5A (1A in relays with 1A nominal current).
5. Change setpoint TABLE 1/50BF SETTINGS/1 PHASE TIMER T1 to 0.050s.
6. Change setpoint TABLE 1/50BF SETTINGS/Nº OUTPUT STAGES to 1.
7. Energize digital input 3POLE BF INITIATE (terminals E7-E8 for relays with expansion board). If the relay has not expansion board, energize CC1 PHASE A BF INITIATE.
8. Increase current applied on A1-A2 (phase A) until contact A12-B12 closes. Check that the operating value of the current is within ± 5% of setpoint (5A for relays with 5A nominal current and 1A for 1A nominal current relays).
9. Repeat step 8 applying current on B1-B2 (phase B). If the relay has not an expansion board energize CC2 PHASE B BF INITIATE.
10. Repeat step 8 applying current on A3-A4 (phase C). If the relay has not an expansion board energize CC3 PHASE C BF INITIATE.

6.10.2. TIMING MEASUREMENT

1. Connect the stop input of the precision timer to the A12-B12 output (trip 1).
2. Apply the operating current level of the previous test to terminals A1-A2 (phase A).
3. Simultaneously energize the digital input 3POLE BF INITIATE and the starting input of the precision timer.
4. After 1 PHASE TIMER T1 (0.050s) the relay will trip.
5. Verify that the actual operating time is equal to 1 PHASE TIMER T1 (accuracy ± 5% or 30 ms, whichever is greater).

7. INSTALLATION AND MAINTENANCE

7.1. INSTALLATION

The relay should be installed in a clean, dry and dust-free place, with no vibrations.

The DBF system is supplied in a 19'' rack case 2 units high. Figure 5 shows the dimension diagram.

The relay should be mounted on a vertical surface. Figure 6 shows a diagram for panel drilling.

Given that the design of the DBF unit is based on high performance digital technology it is not necessary to calibrate the relay. However if the tests show that it is necessary to readjust the relay, it is recommended to return the unit to the factory to check it.

7.2. CONNECTION-TO-GROUND AND DISTURBANCES SUPPRESSION

The terminal (see Figure 2) should be connected to ground so that the disturbance suppression circuits in the system works correctly. This connection should be as short as possible (preferably 25 cm or less) to guarantee maximum protection. In this way the capacitors that are internally connected between the inputs and ground divert high frequency disturbances directly to ground without passing through the electronic circuits. Then the internal circuitry is perfectly protected.

In addition this connection also guarantees the physical safety of the personnel when handling the relay, since the whole casing is connected to ground.

7.3. MAINTENANCE

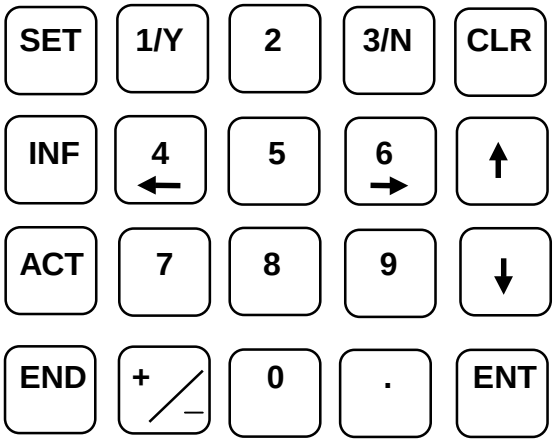
Given the important role that the protection relays play in the operation of any installation, a periodic program of tests is highly recommended. The unit incorporates built-in diagnostic functions that permit the fast identification of some of the most likely circuit failures. Testing the unit is recommended at intervals of 2 years or more. Although the built-in diagnosis does not reduce the average time between failures, it does increase the availability of the protection because it allows a drastic reduction in the average interruption time involved in detecting and repairing the fault.

The set of tests which can be performed to test that all aspects of the DBF unit function properly is described in detail in the chapter entitled ACCEPTANCE TESTS.

Since most of the protection and communications functions are integrated in two separate programs, it is unlikely that faults will occur due to problems of wear and tear, short-circuits or aging which are typical in other electromechanical protection systems, whether analogue or hybrid. Moreover, a failure in the communications processor does not affect the protection functions, which are implemented by a dedicated processor.

8. KEYBOARD AND DISPLAY

The DBF has a 20 key keyboard and a liquid crystal DISPLAY with 32 characters, divided into two rows of 16 each. The following diagram shows the appearance of the DBF Keyboard:



The keyboard program uses menus to access the different relay functions. These functions are divided into five large groups, each of which is accessed using a different key. These groups are the following:

Information: Provides data about the state of the relay, alarms, breaker status, record of currents, events record, etc. This menu is accessed using the **INF** key.

Control: Permits reset of latching relays, oscillography triggering and synchronizing. This menu is accessed by pressing the **ACT** key.

Settings: Permits viewing and changing all the relay settings. This menu is accessed by pressing the **SET** key.

Configuration menu: Permits access to the system configuration and the modification of the passwords, access, communication speeds, etc. This menu is accessed by keying in the code "**7169**" In order to access this mode the relay should be on the main screen.

Single key menu: By pressing the **ENT** key the DBF can be operated in a simplified mode. It is not necessary to remove the plastic cover on the front of the relay to access this mode. In steady state the DBF shows the following message on the DISPLAY :

DBF
GENERAL ELECTRIC

At this point the five groups mentioned above can be selected. In order to select a different group the user must return to this screen and press the key that corresponds to that group.

Once inside a group it is not possible to select a different one. Movement to any other group is carried out using the following keys : **ENT, CLR,** and the **up, down, left, right arrows.** Their function is as follows:

ENT: Accepts the option that is shown on the screen. It is equivalent to go down one level in the menu tree.

CLR: Quits the option that is shown on the screen. It is equivalent to go up one level in the menu tree.

UP/DOWN ARROWS: Change options. The equivalent of a horizontal movement within a menu. When the required option appears on the screen it can be selected with the **ENT** key.

LEFT/RIGHT ARROWS: Show the different possibilities of a given setting. It is not used for all settings. When the required option appears on the screen it can be selected with the **ENT** key.

8.1. MENU TREE.

The DBF has different menus divided into levels. The Level 0 is the steady state screen. The Level 1 of the different menus is accessed by pressing the corresponding group key (SET, INF, etc.). The scrolling within a given level is done by using the UP and DOWN arrows. It is possible to go down to levels 2 and 3 by pressing the **ENT** key. Press **CLR** to go up a level within the menu tree. The Level 1 for each of the five groups is shown in the following table :

Group	Level 1	Description
SET	VIEW SETTINGS	View settings
	CHANGE SETTINGS	Change settings
	CHANGE COUNTER	Change counters
INF	STATUS	Shows the status of the relay
ACT	SET DATE/TIME	Change date and time
	TRIGGERING	Triggers the oscillography
ENT	I_a	Ia current in primary Amps
	I_n	In current in primary Amps
	I^2t A COUNTER	Accumulated kA^2 sec. for phase A
	Nº OPENINGS	Accumulated number opens
	3/2-Phase Logic	Shows logic for 50BF High Set.
	50BF Pickup	Shows status of 50BF
	Relay ON/OFF	Relay ON/OF condition
	52A Status	Breaker Pole A (open/closed)
	52B Status	Breaker Pole B (open/closed)
	52C Status	Breaker Pole C (open/closed)
	LATCHING RELAY 1 Status	Latching Relay 1 (open/closed)
	LATCHING RELAY 2 Status	Latching Relay 2 (open/closed)
	DATE & TIME	Shows date and time
Hidden menu, typing this code: **7169**	NETWORK SPEED	PORT3 (remote) comm. Speed
	NETWORK STOP BITS	PORT3 (remote) Stop bits
	LOCAL SPEED	PORT1&2 (local) comm. Speed
	LOCAL STOP BITS	PORT1&2 (local) Stop bits
	LOCAL SETTINGS	Local settings change allowed
	REMOTE SETTINGS	Remote settings change allowed
	LOCAL OPERATION A	Local operations allowed
	REMOTE OPERATIONS	Remote operations allowed
	UNIT NUMBER	Number of the unit
	PASSWORD	View/Change comm. Password
	t TIME-OUT	Max. t between 2 synch signals (only for relays in DDS integrated systems)

8.2. SETTINGS GROUP (SET KEY)

This group allows to see and modify the DBF settings. It is accessed by pressing the **SET** key when the DBF is in steady state. When the **SET** key is pressed the following message appears on the screen:

VIEW SETTINGS
PROTECTION

When the UP/DOWN arrows are pressed the message changes to:

MODIFY SETTINGS
PROTECTION

And the last UP/DOWN action gives:

MODIFY COUNTERS
PROTECTION

For the above windows, the menu tree is shown in the following tables. Note that to go down a level in the tree the **ENT** key must be pressed, and the **CLR** key to go up

Level 1	Level 2	Level 3	Level 4
VIEW PROTECTION SETTINGS	GENERAL SETTINGS	RELAY STATUS	In/Out of service
		IDENTIFICAT	20 characters
		FREQUENCY	50 – 60 Hz
		PHASE CT RATIO	1-4000
		GROUND CT RATIO	1-4000
	BREAKER SETTINGS	BREAKER NUMBER	4 digits
		KI2t OP. MODE	Fixed / Measuring
		KI2t INT TIME	0.03 - 0.25 s
		KI2t LIMIT	1 – 999999 kA2s
	ACTIVE TABLE SET	ACTIVE TABLE	1 –3
	OSCILLOS MASK	PREFAULT CYCLES	0-4
		PICKUP	ENABLE/DISABLE
		1st STAGE TRIP	ENABLE/DISABLE
		2nd STAGE TRIP	ENABLE/DISABLE
		INTERNAL ARC	ENABLE/DISABLE
		50BF A TRIP	ENABLE/DISABLE
		50BF B TRIP	ENABLE/DISABLE
		50BF C TRIP	ENABLE/DISABLE
		50BF 3P TRIP	ENABLE/DISABLE
		EXTERNAL TRIGGER	ENABLE/DISABLE
		COMM. TRIGGER	ENABLE/DISABLE
		HI-SET A PICKUP	ENABLE/DISABLE
		HI-SET B PICKUP	ENABLE/DISABLE
		HI-SET C PICKUP	ENABLE/DISABLE
		50BF A INIT	ENABLE/DISABLE
		50BF B INIT	ENABLE/DISABLE
		50BF C INIT	ENABLE/DISABLE
		LO-SET A PICKUP	ENABLE/DISABLE
		LO-SET B PICKUP	ENABLE/DISABLE
		LO-SET C PICKUP	ENABLE/DISABLE
		3 POLE 50BF INIT	ENABLE/DISABLE
		NEUTRAL PICKUP	ENABLE/DISABLE
		ARC A PICKUP	ENABLE/DISABLE
		ARC B PICKUP	ENABLE/DISABLE
		ARC C PICKUP	ENABLE/DISABLE

Level 1	Level 2	Level 3	Level 4
	FUNCTION PERMIT	50BF 1P FUNCTION 50BF 3P FUNCTION 3P NO INT FUNCT.	PERM/NON-PERM. PERM/NON-PERM. PERM/NON-PERM.
	50BF SETTINGS T1	PH HISET PICKUP PH LOSET PICKUP NEUTRAL PICKUP 1 PHASE TIMER T1 3 PHASE TIMER T2 3P NO I TIMER T3 BF LOGIC (3P/2P) SEVERE FAULT 3P LOW LOAD 2P Nº OUTPUT STAGES 2nd STAGE TIMER	1.0-12A * 1.0-12A * 0.5-6.0A * 0.05-2s 0.05-2s 0.05-2s 3 PHASE/2 PHASE PERM./NON-PERM. PERM/NON-PERM 1 / 2 0.05-2s
	50 BF SETTINGS T2	Same than for TABLE 1	
	50 BF SETTINGS T3	Same than for TABLE 1	
	INTERNAL ARC SET T1	INT ARC PICKUP INT ARC TIMER	0.05-1A 0.1-2.0 s
	INTERNAL ARC SET T2	Same than for TABLE 1	
	INTERNAL ARC SET T 3	Same than for TABLE 2	

To change any setting the procedure is as follows:

- Press the SET key.
- Select the option MODIFY SETTINGS (using ↑↓ arrow keys).
- Press ENT key.
- Select the required setting group in the menu tree (with ↑↓ arrow keys).
- Press ENT key.
- Select the required specific setting (with ↑↓ arrow keys).
- ENTER the value to be modified (or select the required value from the list of available settings using right/left arrow keys).
- Press the **ENT** key.
- Press the **END** key.
- The relay will request confirmation of the change by means of the following message:

CONFIRM
Y/N

- To confirm the change, press the **1/Y** key. (If not, press **3/N**).
- The relay will then show the following message on the screen (LCD):

SETTINGS CHANGE
EXECUTED

- Press the **CLR** key four times to return to the main first screen (rest).

If the setting entered is outside the limits of the valid range, the relay will not accept the change and will show the following message:

SETTING OUT OF RANGE

Some settings do not accepts numeric values; instead of that, different possibilities will be shown by pressing left/right arrow keys.

To perform **MODIFY OF PROTECTION COUNTERS**, the available menus are:

Level 1	Level 2	Level 3	Valid Range
MODIFY COUNTERS PROTECTION		I2t A COUNTER	0-999999
		I2t B COUNTER	0-999999
		I2t C COUNTER	0-999999
		Nº A OPENINGS	0-9999999
		Nº B OPENINGS	0-9999999
		Nº C OPENINGS	0-9999999

8.3. INFORMATION GROUP (INF KEY)

On the steady-state(no communications request), the LCD display at the front of the relay shows the following:

DBF
GENERAL ELECTRIC

By pressing the **INF** key, the next screen will show:

STATUS

This group provides information about the DBF. Press the **ENT** key to access this group. The information displayed is:

- Model of DBF relay
- Data Base Number
- Protection Software Version
- Comm. Software Version
- Phase A Current
- Phase B Current
- Phase C Current
- Neutral Current
- I^2t phase A Counter
- I^2t phase B Counter
- I^2t phase C Counter
- Number of phase A Openings
- Number of phase B Openings
- Number of phase C Openings
- Type of Logic (2P/3P)
- High-set Pickup Status - ∅A
- High-set Pickup Status - ∅B
- High-set Pickup Status - ∅C
- Low-set Pickup Status - ∅A
- Low-set Pickup Status - ∅B
- Low-set Pickup Status - ∅C
- Neutral Pickup Status
- 50BF Initiation Status - ∅A
- 50BF Initiation Status - ∅B
- 50BF Initiation Status - ∅C
- 50BF 3Pole Initiation Status
- Arc Pickup - ∅A
- Arc Pickup - ∅B
- Arc Pickup - ∅C
- General 50BF Pickup Status
- Relay Ready
- Active Table Number
- Status of Circuit Breaker - ∅A
- Status of Circuit Breaker - ∅B
- Status of Circuit Breaker - ∅C
- Latching Relay 1 Status
- Latching Relay 2 Status
- Local Connection Status
- Date and Time Status
- Communications EEPROM Status
- Communication Settings (User or Default)
- Protection Link Status
- IRIG-B Link
- Actual Date and Time

8.4. CONTROL GROUP (ACT KEY)

Being on the steady-state screen of LCD at the front of the relay, by Pressing **ACT** key, the following will prompt:

SET
DATE/TIME

Pressing **ENT** key the system allows to set the date and time by entering the year, month, day hour, minutes and seconds in this sequence. After each setting the **ENT** key must be pressed.

If instead of pressing the **ENT** key when the **SET DATE/TIME** screen appears, the arrow key (up or down) is pressed, the next screen will be shown:

COMMUNICATION
TRIGGER

By pressing **ENT** key, the following sequence will be displayed:

- CONFIRM: Yes/No ?
- OPERATION EXECUTED/OPERATION CANCELED

8.5. SINGLE KEY MENU

Being on the steady-state screen of LCD at the front of the relay, by Pressing **ENT** key, the “single key menu” will be accessed. Then, the information displayed while step by step pressing **ENT** key is:

- Phase A Current
- Neutral Current
- I^2t Phase A Counter
- Number of phase A Openings
- Type of BF Logic
- 50BF Pickup Status
- Protection Status
- Circuit Breaker ∅A Pole Status
- Circuit Breaker ∅B Pole Status
- Circuit Breaker ∅C Pole Status
- Latching Relay 1 Status
- Latching Relay 2 Status
- Date and Time

8.6. CONFIGURATION MENU.

The DBF has a configuration unit which can only be accessed by means of the keyboard.

To enter the configuration, start from the main screen '**DBF – GENERAL ELECTRIC**' and use the keyboard to enter a four-digit code. If the code is correct the access to the configuration unit is permitted. If not it returns to the main screen.

The code is unique for all the DBF relays and is not intended to be a password, but rather a simple safety measure to avoid accidental changes to the configuration. This code is **7169**, chosen to coincide with the ASCII code for the initials GE.

After pressing 7169 at the front keyboard, and scrolling with the arrow keys, the following information will appear:

- **NET. BAUDRATE :** The speed in bauds which the DBF will use for serial communications through the remote port. The possible speeds are between 1200 and 19200 bauds.
- **NET.STOP BITS :** The number of stop bits which are added to each byte which is transmitted on the serial line. It is treated as a binary logic setting selected by means of the logic key **1/Y** for 1 and **3/N** for 2.
- **LOC. BAUDRATE :** as above but for local communications.
- **LOC. STOP BITS :** As above but for local communications.
- **LOCAL SETTINGS :** Settings changes by local communications (allowed/not allowed).
- **REM SETTINGS :** Settings changes by remote communications (allowed/not allowed).
- **LOC OPERATIONS :** Operations being performed by local communications (computer directly connected) (allowed/not allowed).
- **REM OPERATIONS :** Operations being performed by remote communications (e.g. modem) (allowed/not allowed).
- **UNIT NUMBER :** Each DBF is identified by a unit number which it uses to identify the messages which are sent to it on the remote communications line. This number can be between 1 and 255.
- **PASSWORD :** To prevent unauthorized persons from communicating with the relay via a communications program and changing the settings or performing operations, the relay has a password. This password can only be seen on the relay display and takes the form of a number between 0 and 99999.
- **t TIME-OUT :** Set to 0 if the relay is not working in a DDS integrated system. Set to the maximum time between two synch signals coming from the PC host, when the relay is working in a DDS integrated system. If a new synch signal is not received in this time the relay will report an error.

FIGURES

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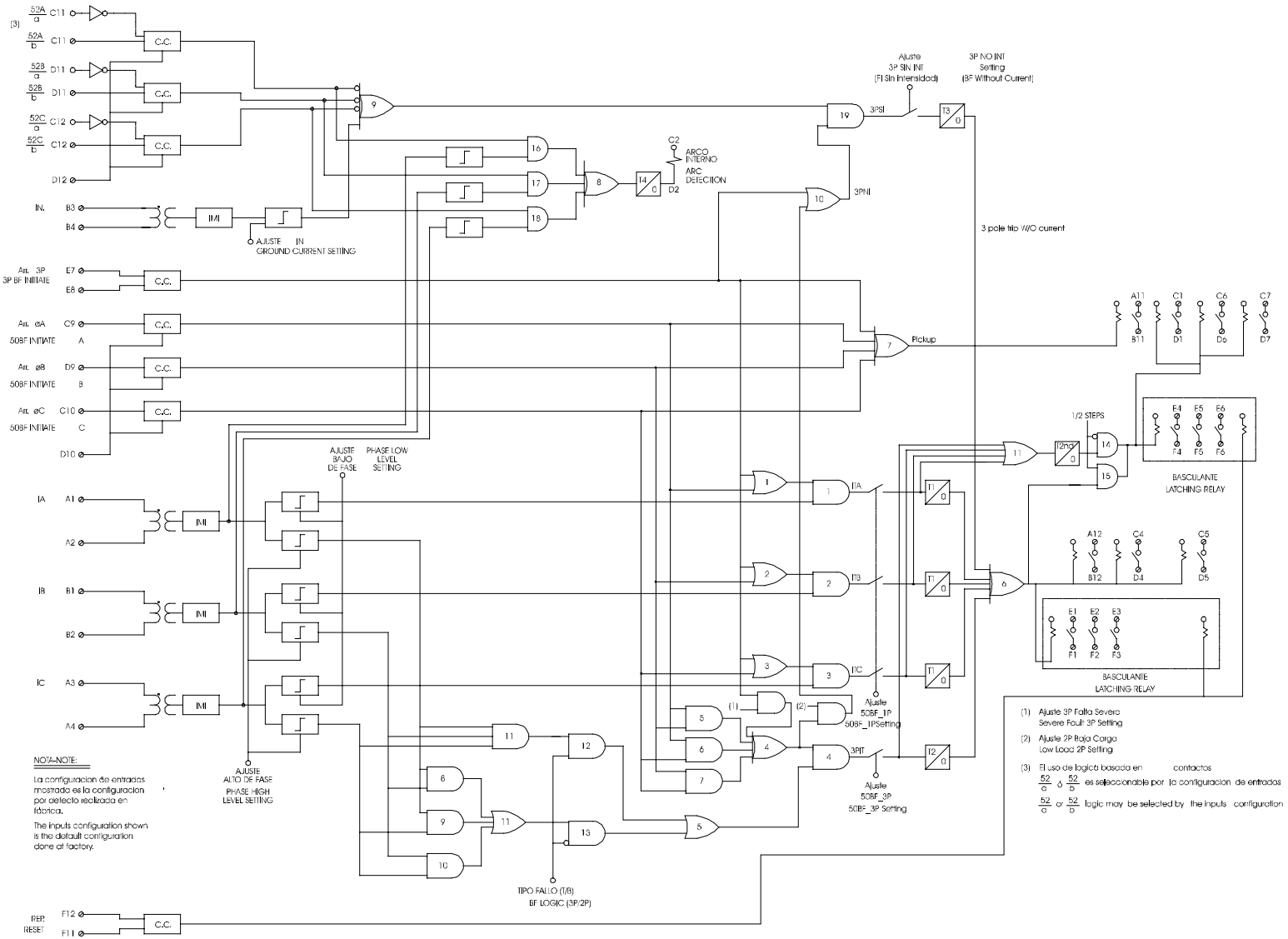

FIGURE 1 BREAKER FAILURE LOGIC (189C4114 SHEET 2)

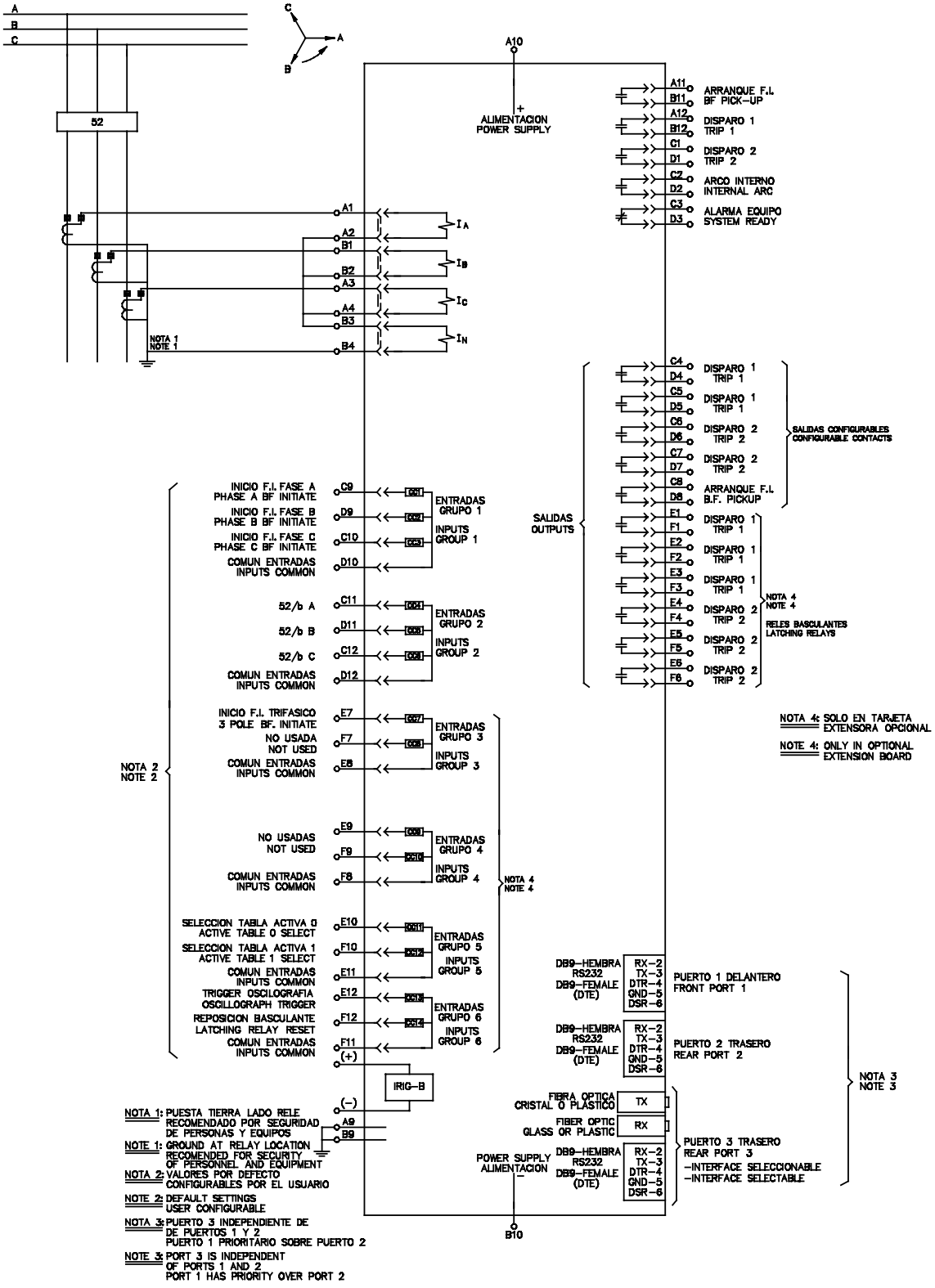

FIGURE 2. EXTERNAL CONNECTIONS (189C4114 SHEET 1)

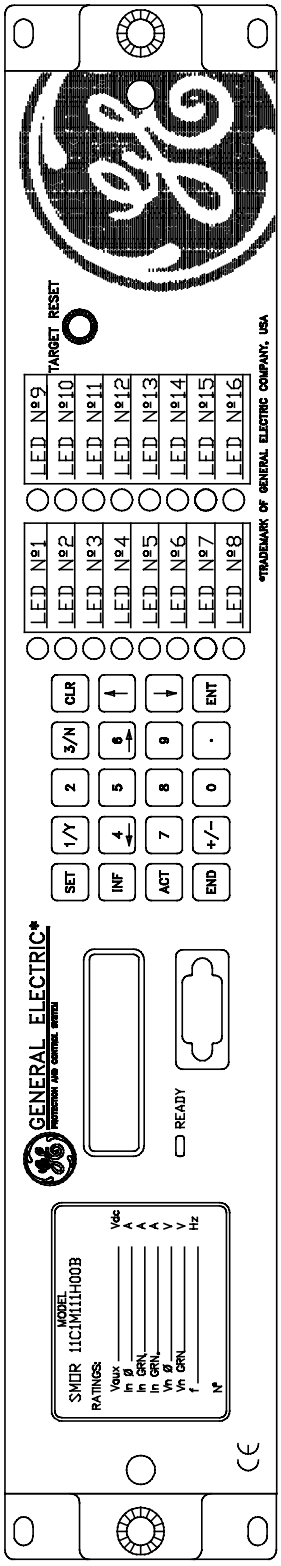

FIGURE 3. FRONT VIEW (226B7412 H9)

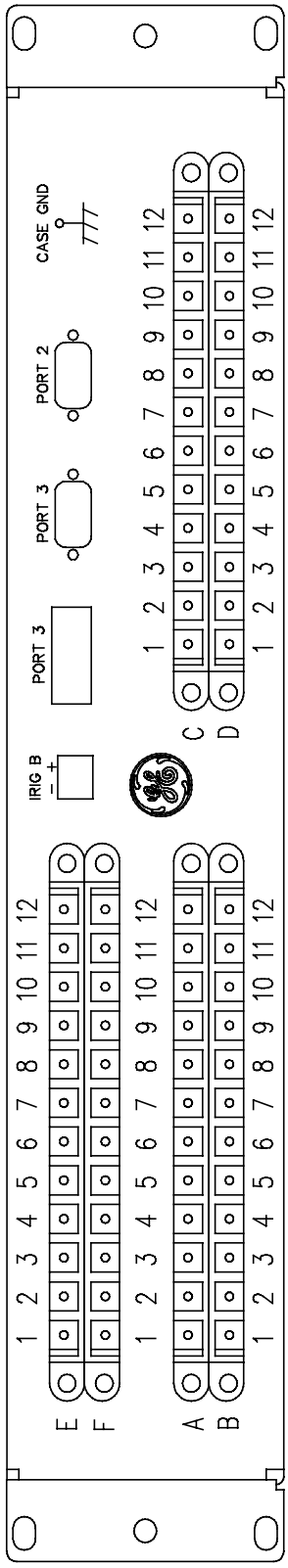

FIGURE 4 REAR VIEW (226B7412H10)

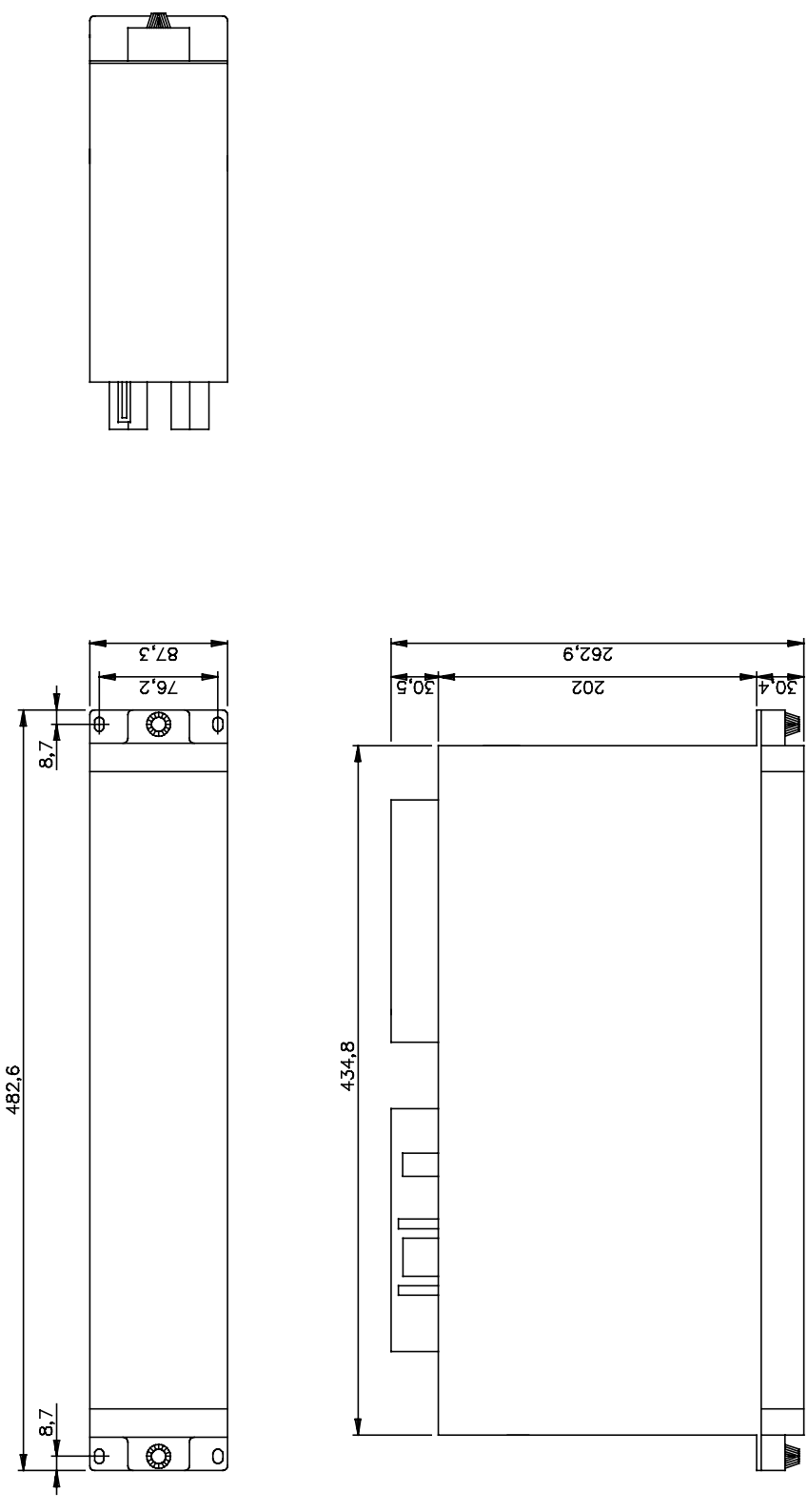

FIGURE 5 DIMENSIONS DIAGRAM (226B6086H10)

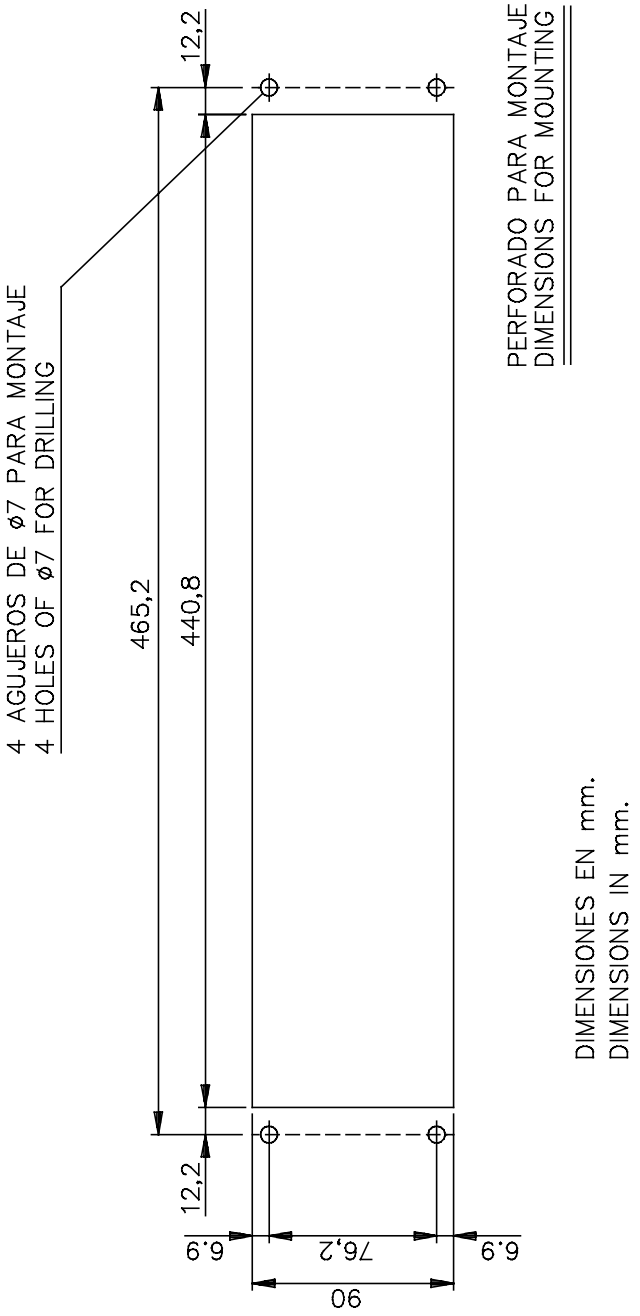

FIGURE 6 PANEL DRILLING (226B6086H10)

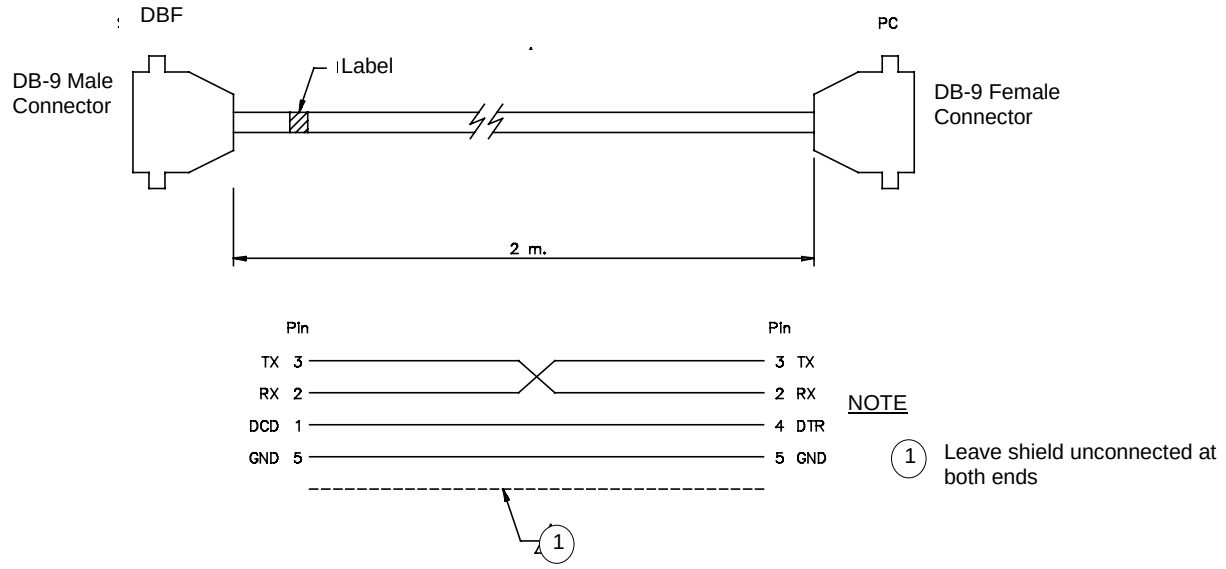

FIGURE 7 RS232 CONNECTION (DBF RELAY TO PC)

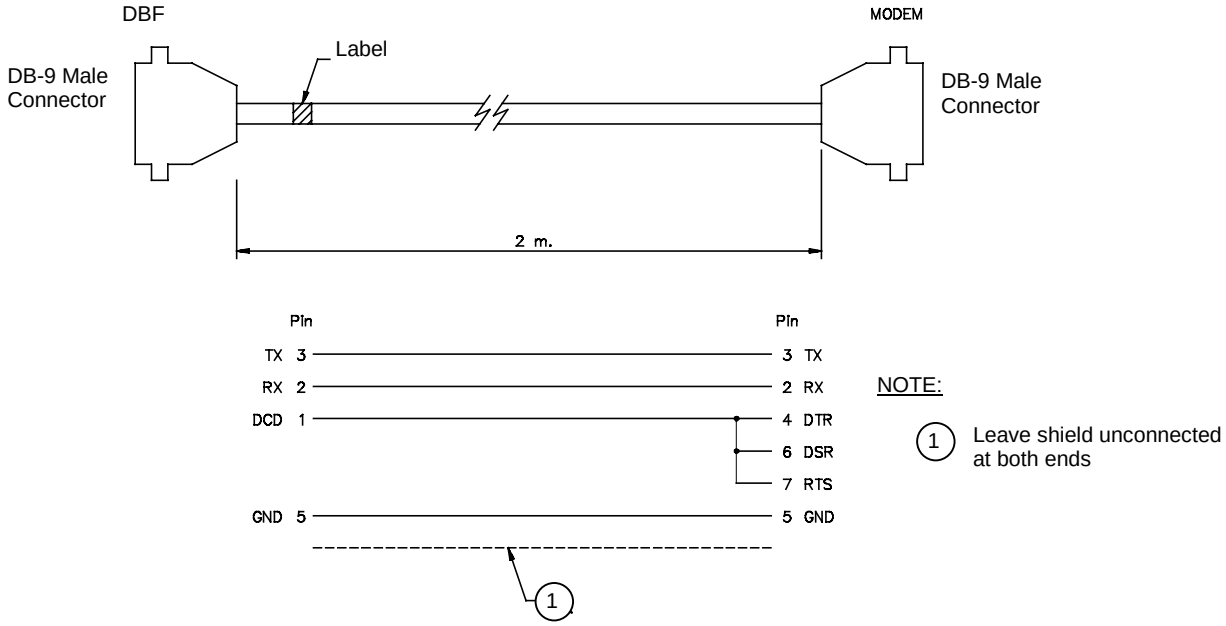

FIGURE 8 RS232 CONNECTION (DBF RELAY TO MODEM)